

CLAIMS

1. An optical article comprising a transparent substrate made of organic or mineral glass, having main front and rear faces, at least one of said main faces comprising a multi-layer anti-reflection coating, wherein said anti-reflection coating comprises at least two visible-absorbing layers comprising a sub-stoichiometric titanium oxide, the visible-absorbing layers being such that the relative transmission factor of visible light T_v is reduced by at least 10%, preferably by at least 40%, and still more preferably by at least 80%, compared with the same article not comprising said visible-absorbing layers.
2. An article according to claim 1, wherein the visible-absorbing layers have an extinction coefficient (k) equal to or greater than 0.2, and preferably varying from 0.2 to 2.4, for all wavelengths in the visible range from 380 to 780 nm.
3. An article according to claim 1 or 2, wherein the substrate is made of organic glass.
4. An article according to claim 3, wherein the organic glass substrate is made of polycarbonate.
5. An article according to any one of the preceding claims, wherein the anti-reflection coating formed on at least one of the faces of the substrate comprises a stack of alternating high refractive index (HI) and low refractive index (LI) layers, wherein:
 - at least one of the visible-absorbing layers is a high index (HI) layer comprising a sub-stoichiometric titanium oxide, and
 - at least one of the low index (LI) layers comprises a mixture of silicon oxide and aluminium oxide.
6. An optical article according to claim 5 wherein the low refractive index layer (LI) comprising a mixture of silicon oxide and aluminium oxide is adjacent to a high refractive index (HI) visible-absorbing layer.
7. An article according to claim 5 or 6, wherein each of the high refractive index layers (HI) of the anti-reflection coating is a visible-absorbing layer made of sub-stoichiometric titanium oxide.
8. An optical article according to any one of claims 5 to 7, wherein each of the low refractive index layers (LI) of the anti-reflection coating comprises a mixture of silicon oxide and aluminium oxide.
9. An article according to any one of the preceding claims, wherein the sub-stoichiometric titanium oxide in the absorbent layers is given by the formula TiO_x , wherein x is less than 2.

10. An article according to claim 9, wherein x varies from 0.2 to 1.2.
11. An article according to any one of claims 1 to 8, wherein the sub-stoichiometric titanium oxide is obtained from a mixture of TiO and Ti₂O₃.
12. An article according to claim 11, wherein the weight ratio of TiO in the mixture of TiO and Ti₂O₃ is at least 50%, preferably at least 60% and more preferably at least 70%.
5
13. An article according to any one of claims 5 to 12, wherein the SiO₂/Al₂O₃ low refractive index layer (LI) contains 1 to 5% by weight of Al₂O₃.
14. An article according to any one of claims 5 to 13, wherein the anti-reflection stack comprises at least four alternating HI/LI layers, and preferably 6 layers.
10
15. An article according to any one of the preceding claims, wherein it comprises an anti-scratch coating formed on the substrate, the anti-reflection coating being deposited onto said anti-scratch coating.
16. An article according to any one of the preceding claims, wherein the anti-reflection coating is deposited exclusively on the rear face of the substrate.
15
17. An article according to any one of the preceding claims, wherein the article is an ophthalmic glass, in particular a sunglass lens, preferably with a high concave curvature, for curvature radii of the concave face of 90 mm or less, preferably of the order of 70 mm.
18. A manufacturing process of an optical article according to any one of claims 1 to 17, wherein all the layers of the anti-reflection stack are deposited by vacuum evaporation.
20
19. An optical article according to claim 1, wherein the relative transmission factor of visible light T_v of said article is at most 40%, preferably at most 30%, more preferably at most 20% and most preferably of the order of 15%.
25
20. An optical article according to claim 14, wherein the anti-reflection stack comprises the following layers:
 - 25-35 nm of a mixture of sub-stoichiometric titanium oxides;
 - 10-20 nm of SiO₂ doped with Al₂O₃;
 - 30 45-55 nm of a mixture of sub-stoichiometric titanium oxides;
 - 40-50 nm SiO₂ doped with Al₂O₃;
 - 35-45 nm of a mixture of sub-stoichiometric titanium oxides;
 - 70-80 nm SiO₂ doped with Al₂O₃.